

6/Pt 28

**REFUSE COLLECTION VEHICLES  
AND METHOD OF MANUFACTURING**

AW  
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Technical Field

The present invention relates to vehicles of the type commonly employed for the collection and transportation of refuse material.

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More particularly, this invention relates to vehicles of the type having a rolling chassis upon which is mounted a storage body, mechanism for retrieving refuse and compacting same within the body and means for ejecting the compacted refuse from the body.

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In a further and more specific aspect, the instant invention concerns a method of fabricating various specific configurations of refuse handling vehicles interchangeably from a single production line utilizing common components and minimal jigs and fixtures.

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Background Art

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Typically, the conventional refuse collection vehicle includes a rolling chassis with a forwardly mounted cab or operator compartment and a rearwardly extending frame. Mounted upon the frame is a body for storage of refuse. A lifter first receives the refuse and dumps it into a hopper for passage into the body. Subsequently, a compactor compacts the refuse within the body. When desired, a tailgate at the rearward end of the body is opened and the load ejected.

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Chassis are characteristically standard units, which are commercially available from various manufactures. In addition to the frame and cab, such units commonly include engine, drive train, and operator controls. Indicative differences among units are attributable to the aesthetic design considerations of the specific manufacturer. The only meaningful variation is the length and strength of the rearwardly extending frame.

Refuse handling equipment mounted upon the chassis, on the other hand, is subject to seemingly endless variations. Initially noted are the basic or general configurations, commonly generically classified as front loader, side loader and rear loader. Each of these, in turn, is manufactured in a seemingly endless array of specific configurations and specifications.

The capacity and the length of the storage body, as well as the manufacturer of the chassis, are generally dictated by the order or request of the consumer with regard to the intended use. Typically, storage capacities vary from approximately six cubic yards to forty cubic yards. Lengths usually range from six feet to thirty-five feet.

Parameters are set on limits of height, width and roadway loading by regulatory agencies such as the federal government and state and local ordinances. Other parameters of the body and associated mechanisms are at the discretion of the manufacturer of the refuse handling equipment.

Numerous shapes and forms of bodies are well known in the art. Immediately apparent are round bodies and rectangular bodies. Height, cross section and specific design specifications are subject to wide variation. For example, rectangular bodies may have planar sides with either square, chamfered or rounded corners. Alternately, a rectangular body may be fabricated of curved panels which join along either a linear or a curved apex. Reinforcement members are equally randomly sized and placed.

The contour and the dimensions of the tailgate are influenced by the corresponding contour and dimensions of the specific body in order to establish a mating relationship. Other components of the refuse handling mechanism, including the hopper, the loader, the packer and the ejector are similarly impacted.

Typically, the fledgling manufacturer of refuse handling vehicles begins by fabricating a single specific unit. A production line is established with the attendant tooling, jigs and fixtures dedicated to that unit. As the company grows, the unique appearance of that initial unit provides name recognition. Subsequently, the company desires to add another refuse handling unit to which the components of the initial unit are not adaptable. A second production line, with attendant dedicated tooling, jigs and fixtures, is then established. Hence, the company expands by increasingly adding production lines. It is commonplace for established manufacturers to have several unique production lines, each producing a specific configuration with a dissimilar appearance. While components may be interchangeable among units produced on a given production line, only minor components are interchangeable with units from another line.

It is immediately apparent that the several production lines require considerable floor space within the manufacturing facility. An immense inventory of subassemblies, components and parts, unique to each line, must be fabricated and maintained. Each requires a substantial investment in dedicated tooling, fixtures and jigs. Numerous employees, including fabrication, supervisory and quality control personnel, each trained and specializing in the fabrication of a particular unit and not readily transferable to another unit, are mandatory to operate the several lines. Accordingly, the manufacture of a refuse collection unit is inordinately expensive; a cost which is passed on the consumer.

The multiplicity of products, differing in appearance greatly diminishes product recognition. Should the company desire to produce yet another configuration, recognition would not be inherently present. Concentration on fewer parts simplifies and enhances quality control.

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The addition of a new unit is replete with various expensive and time consuming considerations. Initially required is extensive engineering to design the unit from conception to finished product. Then, additional floor space must be acquired and allotted to the establishment of yet another production line. New tooling and fixtures must be crafted. Finally, additional personnel must be acquired and trained.

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It would be highly advantageous, therefore, to remedy the foregoing and other deficiencies inherent in the prior art.

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Accordingly, it is an object of the present invention to provide a method of producing a congeneric series of diverse refuse collection vehicles with minimal components and subassemblies.

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Another object of this invention is the provision of means whereby variously configured refuse collection vehicles may be produced, interchangeably, upon a single production line.

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And another object of the invention is to provide a method of fabricating a fleet of diverse refuse collection vehicles utilizing mutual tooling, jigs and fixtures.

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Still another object of the instant invention is the provision of means of producing a fleet of refuse collection vehicles sharing numerous common parts, components and subassemblies.

Yet another object of this invention is to provide means for producing a variety of refuse collection vehicles with substantially reduced inventory.

5      And still another object of the invention is the provision of a method of  
production requiring reduced floor space, personnel and other facilities.

Yet still another object of immediate invention is to provide a method of  
manufacturing whereby the time and expense of adding a new product will be  
substantially reduced.

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And a further object of the invention is the provision of a method of readily  
producing refuse collection vehicles of varying capacity.

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A still further object of the invention is to provide a method of manufacture  
whereby a refuse collection vehicle of a specific configuration is readily and  
easily convertible to another configuration.

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And still a further object of the invention is the provision of a method,  
according to the foregoing, which will substantially reduce the cost of  
fabricating refuse collection vehicles.

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Disclosure of the Invention

Briefly, to achieve the desired objects of the instant invention in accordance with a preferred embodiment thereof, provided is a congeneric series of refuse collection vehicles (front loader, side loader and rear loader) manufactured from modules. The primary modules are the body module, the tailgate module and the hopper module. The body module is preferably manufactured with a constant cross-sectional perimeter, shape or profile. The refuse storage capacity of the body module is changed by varying the length of the body module. The tailgate module and the hopper module are manufactured to have a cross-sectional perimeter that mates with the cross-sectional perimeter of the ends of body module where they overlie each other. The lifter module is added to the chassis, the tailgate module, the hopper module or the body module. The modules are formed from a base set of pieces that are the same for each module and a selected/specified set of pieces that are dictated by the type of refuse collection vehicle selected. The dedicated tooling, fixture and jigs are the same for each selected/specified module.

### Brief Description of Drawings

5 The foregoing and further and more specific objects and advantages of the instant invention will become readily apparent to those skilled in the art from the following detailed description of preferred embodiments thereof, taken in conjunction with the drawings in which:

10 Figure 1 is a schematic flow diagram illustrating the selection/specification and fabrication of a refuse collection vehicle in accordance with the method of the instant invention;

Figure 2 is an exploded perspective view of a refuse collection body, tailgate and hopper modules of a unit fabricated according to the diagram of Fig. 1 as it would appear prior to installation upon a vehicle chassis;

15 Figure 3 is a side elevational view of a completed refuse collection vehicle, herein depicted as a side loader for purposes of illustration, constructed in accordance with the teachings of the present invention and including the body, tailgate and hopper module seen in Fig. 2;

20 Figure 4 is a perspective view of the refuse collection vehicle of Fig. 3 as it would appear in operation when lifting and dumping a refuse container;

25 Figure 5 is a perspective view of an embodiment of a tailgate module, especially adapted for use in connection with a front loader or side loader collection vehicle, that can be fabricated in accordance the method of this invention;

30 Figure 6 is a perspective view of another alternate embodiment of a tailgate module, especially adapted for use with a rear loader vehicle, that can be fabricated by the method shown in Fig. 1;

Figure 7 is a perspective view of an alternate embodiment of a tailgate module embodying the teachings of the instant invention;

5 Figure 8 is a perspective view of a another refuse storage body module fabricated in accordance with the method of Fig. 1, the immediate body module being coincident with the body of Fig. 2, except being shorter in length;

10 Figure 9 is a perspective view of the refuse storage body module shown in Fig. 2;

Figure 10 is a perspective view of yet another refuse storage body module, similar to the body module seen in Fig. 2 except for having an extended length, constructed in accordance with the teachings of the instant invention;

15 Figure 11 is a side elevational view of a lifter and hopper module, especially suited for use in connection with a front loader refuse collection vehicle, fabricated by the method of Fig. 1;

20 Figure 12 is a side elevational view of a side loader hopper and lifter module in accordance with the teachings of the present invention;

Figure 13 is a top plan view of the module seen in Fig. 12;

25 Figure 14 is a elevational view of another hopper module constructed by the method of Fig 1, and useful in connection with a manually loaded side loader refuse collection vehicle;

30 Figure 15 is a side elevational view of a rear loader refuse collection vehicle embodying the principles of the instant invention;



Figure 16 is a side elevational view of an alternate rear loader refuse collection vehicle fabricated in accordance with the teachings of this invention; and

5 Figure 17 is a side elevational view of a front loader refuse collection vehicle as may be constructed by the method illustrated in the flow diagram of Fig. 1.

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### Best Mode for Carrying out the Invention

Turning now to the drawings, in which like reference characters indicate corresponding elements throughout the several views, attention is first directed to Figure 1, wherein box 30 denotes a specific unit order for a refuse collection vehicle (RCV), incorporating specifications in accordance with the desires of a customer or the manufacturer. Exemplary, the order will list the type of chassis, the type (size) of body and the type of configuration (front loader, side loader, rear loader, etc. refuse collection vehicle - RCV). As an example, the type of chassis could be a Peterbilt® truck of a cab over style and with a 200 inch wheel base and matching frame among other selections as shown in Figure 2. The body size could be a 20 cubic yard. The type of configuration could be a side loader RCV.

Thus, the type of chassis is selected from different manufacturers, different cab styles (cab over, front engine, etc.), different wheel bases and bed lengths, etc. The type of body (size) is selected from various sizes. In the preferred embodiment, the cross-section remains the same and the length is changed to create the various storage capacities of the body 42. The type of configuration is selected from a front loader, a side loader or a rear loader, automatic mechanical lifter, combinations of manual and mechanical lifter, etc. RCV.

In Figure 1, the flow lines 40, 50 and 60 indicate the selections/specifications that are made in the manufacture of a refuse collection vehicle.

The chassis selection/specification is fed along flow line 40 to arrow 40A, which indicates the model of chassis selected. In the example chosen for purposes of illustration, the specified chassis is a Peterbilt® truck of cab over style cab and a 200 inch wheel base. The chassis 42 is usually made by a truck

manufacturer and delivered to the RCV manufacturing plant. Arrow 40B indicates the options that have been specified, such as cab over, engine make and size, automatic transmission, axles, suspension, color, seats, tires, etc. . Arrow 40C denotes the selection of paint for the chassis 42. The body specification is fed along flow line 50. Arrow 50A denotes the selected length of the body, which is varied to yield the desired storage capacity. Arrow 50B indicates the paint selection for the body and the loader.

The configuration selection/specification is fed along flow line 60. Flow lines 70, 80, 90 and 100 indicate the manufacture of elements such as, the body module 72, the tailgate module 82, the hopper module 92 and the lifter module 102, respectively. These elements are added to each other and to the chassis to form the refuse collection vehicle.

Flow line 70 manufactures the body module 72. Body module fixture 73 holds the materials that make the body module 72 so that they can be joined together to form the body 72 module, usually by welding. After the body module 72 has been manufactured, the specified hydraulic components, arrow 60A, electric components, arrow 60B, and other components, such as, mounting brackets, arrow 60C, are added to the body 72.

Flow line 80 manufactures the tailgate module 82. Tailgate module fixture 83 holds the materials that are joined together to form the tailgate module 82, usually by welding. The materials for the tailgate module are a base set of tailgate module pieces denoted by arrow 80A and a specified set of tailgate module pieces indicated by arrows 60D, 60E. The specified set of tailgate module pieces is dictated by the selected type of configuration (front loader, side loader or rear loader RCV). The rear loader tailgate module 82B, 82C can operate by hand loading or manual loading or by using a mechanical assist lifter 102C which is an option that can be selected. Tailgates are shown in

USPN 3,899,091 to Fred T. Smith issued August 12, 1975, USPN 3,921,832 to Fred T. Smith issued November 25, 1975, USPN 4,954,020 to Fred T. Smith et al issued September 4, 1990, and USPN 5,478,188 to George A. Rea et al issued December 26, 1995, all of which are incorporated by reference herein.

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Flow line 90 manufactures the hopper module 92. The hopper module of the rear loader is usually manufactured as part of the tailgate module 82B, 82C. Hopper module fixture 93 holds the materials that are joined together to form the hopper module 92, usually by welding. The materials for the hopper module 92 are a base set of hopper module pieces denoted by the arrow 90A and a specified set of hopper module pieces indicated by arrow 60F. The base set of hopper module pieces is always the same for any hopper module. The specified set of hopper module pieces is dictated by the selected type of configuration.

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Flow line 100 manufactures the lifter module 102B of the side loader RCV. The lifter module 102A of the front loader RCV is usually manufactured as part of the hopper module. The lifter module 102C of the rear loader RCV is usually manufactured as part of the tailgate module. The lifter module fixture 103 holds the materials that are joined together to form the side lifter module 102B, usually by welding. The materials for the lifter module comprise a base set of lifter module pieces denoted by arrow 100A and a specified set of lifter module pieces indicated by arrow 60G. The specified set of lifter module pieces is dictated by the selected type of configuration (front loader or side loader RCV). Lifters are shown in USPN 4,461,608 to Robert H. Boda issued July 24, 1984, USPN 4,566,840 to Fred T. Smith issued January 28, 1986, USPN 5,026,104 to John W. Pickrell issued June 25, 1991 and USPN 5,478,188 to George A. Rea et al issued December 26, 1995, all of which are incorporated by reference herein.

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Flow line 110 further manufactures the chassis 42. The hydraulic lines and components etc., as denoted by arrow 60I, and the controls, wiring and other accessories as denoted by arrow 60J that are dictated by the selected or specified configuration are added to the chassis 42. Also the chassis is painted as indicated by arrow 40B and has options, such as decals, television monitors, sign brackets, strobe lights, etc. added as indicated by arrow 40C. The tailgate module, hopper module or lifter module can be manufactured on the appropriate fixture then removed and brought to the body module or chassis or the fixture can be moved to the body module or the chassis.

Figure 2 shows the tailgate module 82, the body module 72 and the hopper module 92 of a side loader RCV. The cross-sectional perimeter, shape or profile of the tailgate module 82 and the end of the body module 74 that mates with the tailgate module 82 are congruent where they overlie each other. The cross-sectional perimeter, shape or profile of the hopper module 92 and the end of the body module 76 that mates with the hopper module 92 are identical where they overlie each other. The cross-sectional perimeter of the tailgate module 82, the body module ends 74, 76 and the hopper module 92 where they mate with or overlie each other are identical throughout the line of RCVs (front loader, side loader, rear loader and modifications and combinations thereof). In particular, the bulkhead 93 of the side loader hopper module 93B will mate with the body module end 76 along the perimeter thereof.

Figures 3 and 4 show a side loader RCV. The body module 72 with tailgate module 82A and hopper module 92B are mounted on the chassis 42 along with lifter module 102B.

Figures 5-14 show some of the various pieces of the refuse collection vehicle that can be used interchangeably to manufacture the selected/specified configuration of a refuse collection vehicle.

Figure 5 shows a tailgate module 82A which is used on a front loader or a side loader RCV.

Figures 6 and 7 show tailgate modules 82B and 82C which are used on rear loader RCVs.

Figures 8-10 show various storage capacity body modules 72. The figures show that the cross-sectional perimeter, area, shape or profile of each body module 72 remains the same and that the length is increased to increase the storage capacity.

Figure 11 shows a lifter module 102A and a hopper module 92A for a front loader RCV.

Figures 12 and 13 show a lifter module 102B and a hopper module 92B for a side loader RCV. It is noted that the lifter module 102B can be mounted to the hopper module 92B or the chassis 42.

Figure 14 shows a hopper module 92C for a manually loaded side loader RCV. The hopper 92C has a powered lifter 102D with a manually filled bucket 104 which is lifted by a link attached to the hopper cover.

Figures 3 and 15-17 show some of the configurations that can be selected/specified and manufactured using the invention. The cross-sectional perimeter, shape or profile at the areas of the hopper module, body module and tailgate module are all identical where they mate with or overlie each other.

Figures 15 and 16 show rear loader RCVs having body modules 72 and tailgate modules 82B and 82C, respectively. The loading can be by hand or by a mechanical assist lifter such as that shown at 102C which is part of the

tailgate module 82C or which could be mounted on the body module 72 near the tailgate area.

Figure 17 shows a front loader RCV having a lifter module 102A, a hopper module 92A, a body module 72 and a tailgate module 82A .

Various changes and modifications to the embodiments herein chosen for purposes of illustration will readily occur to those skilled in the art. For example, the cross sectional perimeter, area, shape or profile of the body module 72 between the ends 74 and 76 can vary. Also instead of being directly connected to the body module 72, the tailgate module 82 and / or the hopper module 92 can be connected via a transition member that would create the mating or overlying perimeter, area, shape or profile. The transition member perimeter could taper from the larger perimeter to the smaller perimeter or be stepped or be a flange between the modules. The transition piece could be an extra piece of the same perimeter, area, profile or shape throughout its length. The body module, tailgate module and hopper module are joined by the appropriate means which can include welding, nuts and bolts, slides, pivots, hydraulic devices, etc. All of the normal elements of a refuse collection vehicle are included in the appropriate modules, such as packers, ejectors, etc. To the extent that such modifications and variations do not depart from the spirit of the invention, they are intended to be included within the scope thereof which is assessed only by a fair interpretation of the following claims.

Industrial Applicability

The present invention is capable of being exploited in the refuse collection industry. The present invention is particularly appropriate for use in manufacturing refuse collection vehicles. Utilization of the present invention can substantially reduce manufacturing costs while concurrently expediting customer orders.

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